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LANDSCAPES OF LEARNING IN A MULTICULTURAL MATHEMATICS CLASSROOM

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Students' motives for learning mathematics cannot be understood by looking solely at mathematical classroom activities. We discuss this claim in a multicultural context using the notion of 'landscapes of learning'. This notion serves as a theoretical and methodological tool that both defines a research perspective and sketches a field of empirical research. In this paper we want to focus on the notion and illustrate its usefulness when researching mathematical learning in multicultural contexts. We draw on data and results of an empirical study on student's foregrounds with 45 teenage students in two 8th grade multicultural classes in Denmark. We show the dialectical relationship between each dimension of the landscape and the whole of it; and how, as a whole, it can help us coming closer to better theorisations.

A LANDSCAPE OF LEARNING FOR RESEARCHING MULTICULTURAL CONTEXTS

Research in mathematical learning in multicultural classrooms has tended to highlight language as a dominant aspect (e.g. Kaiser, 2003). Although important understandings have resulted from that type of research, we notice that selecting one particular aspect does not allow grasping the social complexity of multicultural classrooms. In our research project "Learning From Diversity" (Alrø, Skovsmose and Valero, 2003, 2005) we have engaged in the study of mathematical learning in multicultural classrooms from a socio-political perspective, interested in both a theoretical and an empirical examination of mathematics education practices in settings where cultural diversity, conflict and dialogue coexist. Such an examination is of extreme relevance in the current situation in Denmark where, similarly to many other European countries, dealing with the cultural diversity of immigrant population is being constructed as a problem and an obstacle for learning, and not as an enriching possibility. In Denmark no attention has been paid to mathematics education in multicultural situations. However, most of what comes to be available for teachers and researchers are results from general education in which immigrants' lack of linguistic competence in the Danish language is a dominant explanatory factor for the lack of successful participation in schooling.

As a response to that situation, we have engaged in the construction of thinking tools that allow us to move from existing simplifications of the predicaments and challenges of mathematics learning in multicultural situations. We have proposed the notion of *landscapes of learning* as a tool to guide us in exploring the empirical field. The notion has a double meaning. First, it represents an interpretation of (mathematics) education as a complex network of social practice that is constituted by different interrelated dimensions. Second, it makes possible to identify specific –

but correlated – dimensions of an empirical field to do research. Thus, it brings together a research perspective and a research field.

Among the many dimensions one could choose, we have decided to select those that recent research with a socio-political perspective emphasised as aspects needed to be considered for a better understanding of the social complexity of multicultural mathematical classrooms. Therefore we operate with the following dimensions of a learning landscape: (a) Students' foregrounds as an experienced socio-political reality (Skovsmose, 1994; Gorgorió & Planas, 2001). (b) Students' construction of identity and of cultural diversities (Sfard & Prusak, 2005). (c) Teacher's perspectives, opinions and priorities of teaching (César & Favilli, 2005). (d) The content of learning, in our case the mathematical content for classroom interaction (Powel, 2002). (e) Tools or resources for learning that students might have available. (f) Classroom interaction among students and between students and teacher (Gorgorió et al., 2002). (g) Family and parents who influence students' priorities (Gutstein, 2003). (h) Friends, who are reference groups for the students (Bishop, 2002). And (i) public discourses about immigrants, schooling and multiculturalism (Martin-Rojo, 2003).

The landscape of learning so defined allows engaging in different kinds of empirical studies addressing one or more dimensions at the time and tackling one or more particular questions. For example, two other researchers associated to our team have chosen to focus on students' identities (Stentoft, 2007) and on family and parents' priorities (Baber, 2007). In other empirical studies, Helle, Ole and Paola have also explored the landscape from classroom interaction and mathematical content dimensions. The results of these studies are under elaboration and will not be mentioned here.

In what follows we illustrate the power of the landscape of learning when researching multicultural mathematics classrooms, drawing from results from an empirical study focused on the foregrounds and motives for engaging in mathematical learning (for details on this study, see Alrø, Skovsmose and Valero, forthcoming) of a group of 45 teenage students in two classrooms in a multicultural Danish public school. In this paper we refer shortly to the design of the particular empirical study from which we draw some data. We then show how the landscape of learning is put into operation in analysing inter-views with the students where we explored students' motives for learning; and we conclude with some remarks about how we see the perspective advancing towards a theory of (mathematical) learning in multicultural settings.

AN EMPIRICAL STUDY ON STUDENTS' FOREGROUNDS

Mælkevejen Skole is a primary and lower-secondary school situated in a suburb of a bigger Danish city. This school hosts students from 29 countries from all over the world. We established collaboration with two 8th grade classes of 24 and 21 students respectively. Half of them come from countries such as Iceland, Ireland, Iraq, Greenland, Lebanon, Malaysia, Somalia, Turkey and Vietnam. The two teachers, a young man and a very experienced man, are both Danish. Despite the diversity of

students, at the time of the research there were no artefacts displayed in the classroom that indicated diversity, except for the names on the students' pigeonholes. From the surface, this classroom would be a typical "Danish" classroom.

The study was carried out in five phases. First, Helle observed the mathematics lessons during a couple of weeks with the purpose of getting in contact with students and teachers, and of having a background information about the classroom practices, though not for collecting data about classroom interaction. Second, Helle invited the students to imagine themselves in ten years and think about how their life would look like. Then students were asked to write a story about themselves and their imagined future lives. Third, students answered a questionnaire related to their present school experiences in general and to school mathematics in specific. From these three phases, the research team produced questions and guidelines for an inter-view (Kvale, 1996) with each student about his or her foregrounds. In the fourth phase, Helle conducted inter-views with students in order to explore the students' foregrounds with respect to mathematics. Finally, the research team inter-viewed the two teachers and asked them to give a guess of what the students would like to do after finishing 9th grade. The intention of this conversation with the teachers was having a background material about how the teachers see the students' foregrounds.

From the different information obtained in the five stages, we concentrate on the inter-views with students and on the students' own narratives about themselves and their future possibilities. The inter-views were audio-taped and protocols about the conversations have been produced in order to make a profile of how students see their school experience and which motives they bring for learning mathematics. The analysis of the inter-views allowed us to illustrate some of the dimensions of our learning landscape. In what follows we show how the different dimensions are relevant for interpreting issues concerning students' motives for learning in multicultural settings. Some dimensions, however, were not touched upon during the inter-views: "Teacher's perspectives, opinions and priorities" and "Classroom interaction". Thus, we are not going to present an empirical evidence of the model; rather, an empirical indication of the relevance of including a variety of dimensions when interpreting students' motives for learning mathematics.

THE DIMENSIONS OF THE LANDSCAPE OF LEARNING IN OPERATION

Students' Foregrounds

Students' foregrounds can be defined as a person's interpretation of his or her learning possibilities and 'life' opportunities, in relation to what the socio-political context seems to make acceptable for and available to the person (Skovsmose, 2005). From the inter-views, it is possible to get an insight into some of the students' hopes and expectations for the future.

Minh likes to go to school. He considers school and mathematics to be very important for his future life, as he wants to become a banker or estate agent: "Something with mathematics - I love numbers."

Natascha is very fond of moving things around in her room and making things better and more beautiful. She estimates the size of the furniture and she calculates and makes drawings of the room. She has just got herself a new room of 25 m², so there is a lot of work for her to do. Natascha wants to be an architect or estate agent. She knows that for her dreams to come true she is supposed to be very good at mathematics. And so she is. In the case of Natascha there seems to be a close connection of her interests, skills and hopes for the future, i.e. her foreground. And mathematics certainly plays an important role in this foreground.

Ryan and Kim both want to become computer scientists. They are well aware that it takes a lot of mathematics, though, to become a computer scientist. In the first place it is a precondition to get good marks in mathematics. "But you also need mathematics for programming and for estimating codes and things like that," Ryan says. They think that being a computer scientist is a well-paid job, but the important thing is having a job that you like.

Thus, many students have a clear imagination of their future education and professional life that is connected with certain ambitions including mathematics. However, a large group of other students do not know if they are going to use mathematics for the profession that they go for, but most of them mention that mathematics is important "for almost everything". Laura, for instance, wants to become a dentist, and she thinks that she is going to use mathematics, but how and why she cannot imagine at all. The same counts for Monica who wants to be a psychologist.

These examples illustrate that the notion of students' foreground is important in order to understand students' motives for learning.

Students' identities and cultural diversities

As mentioned, Mælkevejen Skole hosts students from many different countries and cultures. In the inter-views, however, none of the students touch upon that subject by themselves. And when Helle asks what difference it makes most of the students claim that: "It makes no difference!" and "It is no big deal!" They have obviously no focus on cultural diversity. But when Helle asks about advantages and disadvantages of being a multicultural class some students express an opinion. Natascha likes the presence of children from all over the world: "I think everybody should have the right to go to school and to learn, no matter where they come from, what colour they have or what language they speak. Everybody should have the right to go to school and get on with their lives. Cultural differences do not mean anything to me." When asked of advantages she says that it is nice to hear about different cultures, for instance how they celebrate Christmas in Vietnam. Tanja thinks that it is exciting with different cultures in school. "You can learn from each others' different ways of doing things".

Although the students seem to be very including and emphasise that multicultural diversity "doesn't mind", it is interesting to observe how their statements often correspond with an 'us-and-them' discourse: "We just talk to them", Gro says. "Maybe their opinions are different, but that doesn't mind. People are just not the same", Hilda adds. Actually, Hilda herself is from Iceland and strictly taken not Danish, but obviously she does not include herself in the 'them'-category. But according to the students, multiculturalism is not much in focus either during the lessons or in the breaks. Minh puts it this way: "It is not important to me. We are all human beings, aren't we?"

The students are well aware of cultural differences, but they seem to agree that to take specific notice is not important. Directly addressed on this subject, however, they can only come to think of a very few examples of "learning from diversity". This indicates that they represent the 'sameness' approach in the Danish public discourse about integration, which implies making 'them' just like 'us' (Alrø, Skovsmose and Valero, 2005). This is an important observation in order to interpret what is happening in the classroom: in particular the phenomenon that diversity is not used as any resource for teaching and learning. In other words the dimension of students' identities and cultural diversities is important as the students' approaches to learning reflect how they identify themselves in a cultural setting. And as we have seen one possibility is to try to neglect cultural differences.

Mathematics

Many students refer to shopping when asked about their use of mathematics in their daily lives. Some of them also refer to weighing and measuring while cooking and baking. Quite a few students, though, state that they only use mathematics when doing their homework.

Many students mention that they find mathematics interesting when it is easy (i.e. when they can find out), but boring when it is too difficult. Tanja does not like mathematics, but actually she does not know why. "Maybe it is because I like to talk a lot, and mathematics is not a talk subject." She thinks she is doing OK in mathematics, but she spends a lot more time on it than the other students, she says. She uses mathematics in her everyday life, especially if she is going to buy things "for instance if there is sale". Some professions might need a lot of mathematical knowledge, she says, but she is not interested in such professions.

Michael wants to become an architect. He likes to draw straight lines, and he is fascinated by the thought that the durability of a house depends on the drawing. Ahmed claims that he wants to be a programmer: "In the future everything will have to do with computers", he says. He thinks that mathematics is easy and that he is good at it, but he is not so fond of it.

Mathematics is important in order to get admission to a higher education. Many students stress this point. For those students, however, it is not mathematics per se, but mathematics and good marks as a ticket to the education they want. Razia is not

sure what it would take to become a nurse, but she suggests biology, "and then you use mathematics, I think. You use mathematics almost for everything." Razia is not able to point to any mathematical content of a nurse's job. Thus, mathematics plays an inferior role in Razias foregrounds. But being good at mathematics and doing well in school are certainly important parts of her educational plans.

It seems obvious that ideas about mathematics make part of students' motives for learning mathematics. However, the students' ideas about how mathematics might relate to their aspirations are rather confused. The value of mathematics operates in an instrumental form, not as a motive based on an insight about mathematics gained as part of the mathematics lessons.

Tools

A few students touch upon the computer as a tool in mathematics education. Ida and Hannah agree that computers are not important in mathematics education. "They can do nothing more than a calculator", they claim. "You do not make any progress in mathematics by using a computer ... you don't gain more knowledge ... it is just a tool." Lisa adds to that: "You can only use Excell. You cannot hand in your homework on a computer for instance."

None of the students talk about having access to tools. In a Danish context students consider access to tools including computers as a natural good.

Family

Minh does not think that his parents think he is good at mathematics. They do not tell him so, but he does not feel good enough and he seems to be sorry about that. Minh's parents are very ambitious on behalf of Minh. The father has got a grill-bar, and he wants his son to get a well-paid job, so he wants him to become a doctor. Minh himself would rather get a job that he is interested in and happy about, but he knows that his father will get disappointed if he chooses "only" to become a banker. Considerations about being a medical doctor have passed Minh's mind.

Paul wants to become a car mechanic or an engineer. Or he would rather say that his mother wants him to become an engineer. He himself has no ambitions of becoming an engineer. He likes cars a lot and would rather like to become a mechanic.

Razia is well aware of the importance for a Muslim woman of being educated. She does not want to end up like her mother: "... my mother, she has no education. So she says, 'I do everything for you. You are having an education. You should not become like me.' [...] Because in Iraq, if you don't get an education, then you marry early. My mother got married when she was 14 years old. And therefore she is afraid." In Iraq it is rather difficult for a woman to get educated, especially in the part of the country where Razia lived. So she is quite clear of the fact that she wants to get educated in Denmark before she goes back to Iraq in the future.

In different ways parents seem to have a major influence on the students' learning motives. The students' ways of engaging in their schoolwork might be in some

harmony with their parents' priorities, or it might represent a reaction. But it is difficult to ignore the parents' perspectives as making part of an interpretation of the students' attitudes towards learning.

Friends and peers

"I like to go to school because of my friends and because it is important to learn in order to get on in life", Natascha claims. Natascha's point coins the most frequent answer among these 15 year olds: The most important thing about going to school is to get friends and to meet with your friends. Therefore, the breaks are considered to be most important. Like Natascha some other students also refer to the importance of learning, but the role of friends seems to occur immediately to the students' minds when asked about school.

Some claims about going to school may relate to the fact that we have to do with teenagers. "I don't like going to school, especially not in the mornings. I am all too tired. But I like being together with my friends", Peter says. Johnny confirms this attitude. He thinks the worst thing about going to school is that it takes so long. "You have to be there all day. There are lots of other things you could spend your time on."

Friends can have good as well as bad influence on students' preferences. But the solid stress of the importance of being with friends when going to school also indicates an important influence of friends for students' learning motives.

Public discourses

A couple of the students touch upon the public discourse on multicultural issues. "We learn about other cultures, but we do not look at them differently. For instance, we have heard about the Ramadan, and we have had food from foreign countries. This is very good, so that you not believe it is like in the news... that they are just somebody who kills other people or things like that. It is good to know how they really are. The picture in the news has nothing to do with the children we know", Susie says. She argues against the media discourse of immigrants as mostly being criminals. The children in her class are not like that.

Another strong issue in the public discourse is the 'headscarf-girls'. Razia who wears a headscarf due to religious reasons comments on that: "I know that...most Danes do not like the headscarf ... it is about racism and so on."

These examples indicate that prejudice that as expressed in the public discourse might have serious consequences, especially for immigrant students' learning motives.

THEORISING ABOUT LEARNING MATHEMATICS IN MULTICULTURAL SETTINGS

The number of dimensions we have suggested for a landscape of learning expands considerably the scope for investigation, which has characterised much theory building within mathematics education research. Our point is that learning

mathematics in a multicultural setting cannot be understood by looking solely at, for instance, mathematical classroom activities or language.

The landscape is developed with a particular reference to learning mathematics in a multicultural setting. However, it is our hope that it could serve as a way of structuring an understanding of learning in many other situations than the one we have addressed. We find that the dimensions we have presented could turn into dimensions of a theory of learning. They represent a way of seeing learning, and seeing learning in contexts. The examples above illustrate that students' motives for learning mathematics is not particularly connected to mathematics as a subject or to the school mathematics tradition.

In the inter-interviews only a few students pointed to the relevance of specific mathematical content for their future life. Only a few expressed a direct connection between school subjects and relevant professional skills. Michael who wants to be an architect finds mathematical drawings very meaningful; Ryan and Kim who are going to be computer scientists know that they are going to use mathematics, but they mention no application of mathematics in that area. The view is more general: "You use mathematics for almost everything" and external: "It is important to get good marks in mathematics". This means that the students' motives for learning mathematics can easily become *instrumental* (Mellin-Olsen, 1987). The importance of getting good marks is the only plausible value to assign to the school subject, if no everyday practice including mathematics is explored. As mentioned, Laura wants to become a dentist, and Razia wants to be a nurse, but none of them can imagine anything about how mathematics could make part of this, even though they assume that mathematics could be relevant. The possible relevance of mathematics seems to be well-hidden in the school mathematics tradition. As a consequence, it might become difficult for some students to see that mathematics could play any significant role in their future. If meaning for students somehow is related to their foreground, then instrumentalism could become a strict implication of the fact that mathematics appears as a clean and isolated subject. Apparently they have not experienced transitions between classroom practices including mathematics and out of school practices including mathematics. None of them mentions that kind of connections.

When the students have left the classroom, there is nothing left which reflects that we are in a multicultural setting. No pictures on the notice board reveal that there are students with different cultural backgrounds. One could think of diversities as a resource for learning and understanding. One could also consider diversities as a cause of possible troubles and difficulties (Alrø, Skovsmose and Valero, 2003). Through our visits to the school we did not see diversities made explicit in the classroom. Our overall impression is that diversities were both hidden and ignored, which was also reflected in the inter-viewing with the students. The students in our study claim that cultural differences are not important, although when asked they reproduce the 'them-and-us' discourse, which is a common construction in the Danish

public discourse. One implication of this discourse is that integration of newcomers is understood as an assimilation process that implies making 'them' just like 'us'.

We certainly have to be careful not to claim too much about the adequacy of a learning landscape as providing an adequate framing for a theory of learning. However, any such adequacy depends on what one sees as the task of theorising. The landscape of learning is something we are researching, but it is also constituted through the way we are researching. In the study above, some dimensions became visible, others did not. Thus the dimensions of the landscape of learning represent our way of looking at the landscape, and at the same time the dimensions constitute the landscape. The argument for choosing one and not a different dimensioning cannot be justified in a direct way. However, there might be an indirect justification that has to do with the observations, which a particular dimensioning of a landscape of learning makes possible. It has to do with the insight that might be crystallised. So our 'justification' of dimensions is to be found in the potentials for theorising about learning mathematics in multicultural settings. If a different dimensioning provides other observations, or other observations provide new dimensions this would be most welcome. Even though one empirical study might reveal 'something', it will never reveal 'everything'.

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